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ABSTRACT

This instructional packet is one of 14 school environmental education programs developed for use in the classroom and at the Dahlem Environmental Education Center (DEEC) of the Jackson Community College (Michigan). Provided in the packet are pre-trip activities, field trip activities, and post-trip activities which focus on the natural history of Michigan. Strategies for using these activities with fourth grade students are also provided. The pre-trip activities focus on Michigan's prehistory, changing populations (including endangered species), glaciers, and plants and animals in Michigan today. These areas are reinforced during indoor and outdoor activities conducted during a field trip at the DEEC. These activities (and lists of formal and non-formal field trip objectives) are provided in a separate field trip guide. The post-trip activities include a valuing exercise, exercises focusing on land use decisions, and exercises related to human ecology. Most of the activities (and corresponding student activity sheets) are highly interdisciplinary and will enhance mathematics, language arts, and social studies as well as science lessons. In addition, students are given opportunities to express their feelings and opinions and develop skills needed to communicate with others and solve problems. (JN)

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Michigan Natural History

Dahlem Environmental Educatior. Center

7117 S. Jackson Road
Jackson, MI 49201
(517) 787-0806, ext. 197

"Michigan Natural History" is one of fourteen school environmental education programs developed by the Dahlem Environmental Education Center of the Jackson Community College. Assistance for the project was provided by the Institute of Museum Services Special Projects Grant #G008103172, of the U.S. Department of Education.

This packet is the result of the combined efforts of:

Martha Monroe, Project Director
Jan Wolanin, Program Intern
Deb Bainer, Program Intern
Erica Salzman, Artist

Special thanks go to the following people for their contributions:

Dr. John Hug, Educational Consultant,
Office of Environmental Education,
Ohio Department of Education
Tom Berkemeier, fourth grade teacher,
St. John's School
Jan Johnson, fourth grade teacher,
St. John's School
Janet Marvin, fourth grade teacher,
Lincoln Elementary

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Jackson Community College

2111 Emmons Road
Jackson, MI 49201
(517) 787-0800

Michigan Natural History

A Spring Activity Packet for Fourth Grade

Michiganders are fortunate to live in a state with a diversity of natural communities and a variety of wildlife. The past history, present condition, and future use of this land comprise important topics of study for your students. After all, as tomorrow's adults they'll determine Michigan's future!

The concepts incorporated into "Michigan Natural History" were chosen after surveying fourth grade curriculums across the country. Most of the activities in this packet are highly interdisciplinary and will enhance math, language arts, and social studies as well as science.

This introduction to Michigan's history can be thought of as a trip through a time machine! Whizzing through the last five billion years, your students will trace the development of life through the major geologic eras. Stopping at the Dahlem Center for a field trip, they will explore some of Michigan's natural communities, plants, and animals. Back in the classroom your students will peer into the future through land use activities.

"Michigan Natural History" is designed to motivate your students to become informed about their environment and responsible for its future. In addition to learning facts about the environment, your students will express their feelings and opinions and develop the skills needed to communicate with others and solve problems.

Just hop in that time machine and turn the page!

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Goals and Objectives

Program Goal

Fourth graders will become aware of the natural history of Michigan.

Program Objectives

Students will:

-demonstrate their knowledge of Michigan's prehistory by sequencing changes that occurred over geologic time.

-understand extinction by researching currently endangered species.

-understand how glaciers shaped the land by identifying land formations.

-demonstrate their knowledge of natural communities by identifying and comparing them.

-understand interdependence in nature by explaining relationships between producers, consumers, and decomposers.

-clarify their values about the environment by expressing and discussing them.

-recognize the value of an environmentally knowledgeable and active citizenry by participating in land simulations.

-recognize human dependency on the natural environment by comparing the producers, consumers, and decomposers in the natural and human environments.

Pre-Trip Activities

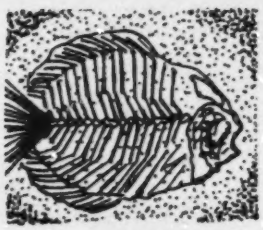
The following information and activity ideas will help you prepare your students for their field trip by introducing four important topics.

1. Michigan Prehistory

It's difficult to appreciate Michigan today without studying its past. No one knows, however, exactly what happened during prehistoric time. A variety of theories to explain life on earth have been suggested -- Darwin's theory of evolution, the Genesis account of creation, and native American explanations of life.

Your class might want to study several of these as well as other theories.

This packet presents evolution, one of the theories developed from the fossil record and emphasized by most science curriculums. Fossils (remains or traces of ancient plants and animals) provide clues to early life. Some scientists think that the world's oldest fossils are over three billion years old. That may have been when life began. From studies of rock formations and the solar system, some scientists think that the world is between 4-5 billion years old.



Since fossils became abundant about six hundred million years ago, scientists have a clearer idea about life on earth from that point on. They've divided the time of life into four different eras. The first (Precambrian Era) includes 88% of time. The remaining eras -- the second (Paleozoic), third (Mesozoic), and fourth (Cenozoic) make up the remaining 12%.

Below are two activities designed to introduce your students to the major changes of geologic time. It's much more important to emphasize the progression of key events than the dates.

Looking Back

Introduce student handout 1 to your students. After they read and discuss it, challenge them to complete handout 2. You may want to help them with billions and millions and the vocabulary definitions on pages 6 and 7.

A Time Line

A time line is a way of recording key historical events. By measuring and marking distances representative of certain lengths of time, different events can be recorded in perspective. On a strip of paper short enough to fit along one wall of your classroom, your students can record the historic events which occurred since the beginning of life on earth! To see how, refer to student handout 3. If this activity is too difficult for some of your students, you could ask them to team up with those more skilled in math. Or, have advanced students make a time line to share with the class. (See answer sheet.)

Want to Keep Going?

- Make plaster casts of "fossils".
- Hunt for fossils in gravel driveways, limestone, and sandstone.
- Make cardboard, paper-mâché, pipe cleaner, or clay models of prehistoric plants and animals and display them in dioramas depicting prehistoric scenes.

2. Changing Populations

In learning about the major eras of life on earth, your students are likely to wonder why some animals aren't around any more and why others are. It's all population dynamics! A population is a group of plants or animals of the same kind that live in the same area interacting with each other and with the environment. Populations increase, decrease, or stabilize depending on these interactions. When a change

occurs in the environment, some individuals may adapt to it and survive. However, if not enough members survive to reproduce and maintain a viable population, the entire species will become extinct.

Dinosaurs provide a good example. It is thought that they lived on the earth successfully for about 140,000,000 years until something caused their population to decrease. Many theories have been postulated to explain why: disease, unsuccessful competition with evolving mammals, or a sudden change in the environment causing a food shortage. Because the species couldn't successfully adapt to the change, dinosaurs disappeared from the earth.

Approximately 95% of all animals that ever lived on the earth are no longer in existence. During the Ice Age in North America, an average of three bird and mammal species died out every 100 years. In sharp contrast to this natural rate, over 500 plant and animal species have become extinct since the Pilgrims arrived. This averages more then 140 species every 100 years. Today biologists claim we are losing one species a day!

Finding Out About Endangered Animals

The drastic increase in the extinction rate is due to human interference. The futures of many endangered species are under current debate. Your students can find out more about endangered species by:

- Writing your state fish and game conservation department to find out about endangered species in your area. (NOTE: The address of the Wildlife Division of the Michigan Department of Natural Resources is: Box 30028, Lansing, Michigan, 48909.)

- Writing the U.S. Fish and Wildlife Service (Department of the Interior, Washington, D.C., 20240) for a list of federally protected endangered species.

- Writing the Government Printing Office (Washington, D.C., 20401) for a copy of the publication "Endangered Means There is Still Time." Cost is $2.50.

- Writing the National Wildlife Federation (1412 16th Street NW, Washington, D.C., 20036) for free fact sheets on endangered animals.

- Inviting a guest speaker from the local chapter of Greenpeace to speak to the class about the

international organization's efforts to save marine animals.

- Finding out about animals in the news by collecting newspaper and magazine clippings about animals whose populations are dwindling.

3. Glaciers

Many scientists think that much of North America was covered by thick masses of moving ice during the fourth (Cenozoic) era. The advance and retreat of these glaciers sculpted Michigan's present landscape. Most of the hills, lakes, boulders, swamps, and valleys in the state were left by the last glacier. The glaciers, huge ice blankets up to a mile thick, slowly scraped across the land, incorporating till (boulders, rocks and dirt) along the way. Michigan's soil was carried to Ohio and Indiana while Canada's rocks were left in Michigan! Boulders that were deposited miles from their original source are called erratics.

When the climate warmed again, the ice melted -- sometimes slowly and sometimes quickly. Long ridges of rock and dirt piled up when the glaciers "stood still", i.e., the front edge melted at the same rate the new ice pushed forward. These ridges are called moraines.

Kettle hole lakes were formed when broken ice chunks became surrounded by rock and dirt carried by the melting water. After an ice chunk melted, a hole remained. Today these holes are large lakes, small ponds, and shallow marshes.

Ice Capades

You and your class can create your very own glaciers! Each pair of students should fill an eight ounce milk carton with water, sand, and gravel and freeze it. The resulting ice blocks represent the glaciers that incorporated rocks and earth during their southward movement into Michigan. Simulate the warming climate and the sculpting of Michigan's land surface by placing the blocks in a sand box and watching them melt. Are depressions and kettle hole lakes formed? During their field trip your class

will see a real kettle hole lake!

4. Michigan Today

Today a large number of plants and animals live in a variety of natural areas in Michigan. Deer, fox, squirrels, raccoons, turtles, and other animals make their homes in fields, forests, and ponds. Each animal's home is in an area where it can find what it needs to live.

Wild animals have these basic needs: food, water, shelter, a food storage area, and an area for eliminating bodily waste. A squirrel's home area, then, should include nut trees, a water source, a nest, and areas where it can store nuts and eliminate its wastes. This home area is called the squirrel's habitat. It is where the animal satisfies all of its needs for survival and reproduction.

Which is bigger -- a fox's habitat or a mouse's habitat? A squirrel's habitat or a deer's habitat?

Many animals have similar needs. Because squirrels, chipmunks, and woodpeckers all need trees in their habitats, these animals may live in the same forest. A community is an area where a set of conditions meets the needs of many animals. The habitats of plants and animals may overlap to form a community.

What communities can you think of? Which plants and animals live in the stream? forest? pond? lawn? marsh? Some animals live in more than one community -- a deer grazes in the field but hides in the forest. Every community operates with three types of organisms -- producers which make food, consumers which eat plants and animals, and decomposers which decay organic matter.

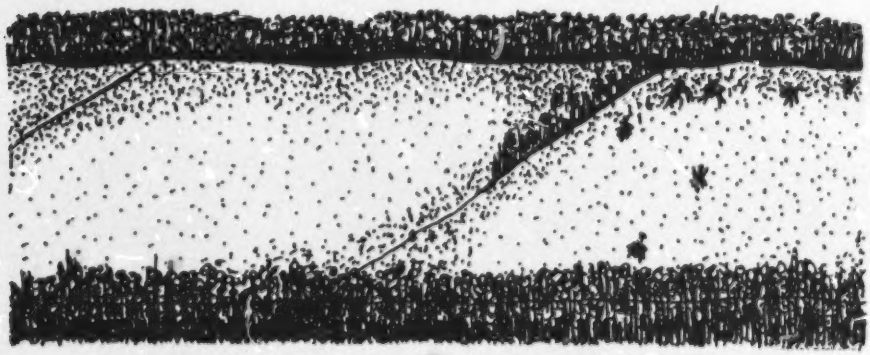
If left undisturbed, communities will constantly change in an orderly progression called succession. Eventually a climax stage of vegetation which is able to reproduce and maintain itself will be reached. Weeds overtake gardens and unmowed lawns; ponds fill in; lichens, moss, and ferns help break rocks into soil.

Exploring the World Around You

The best way to really understand habitats, communities, and succession is to go outside and observe. By taking a careful look at the ecology of the schoolyard, your students will be well-prepared for their field trip.

If your students are unaccustomed to learning outdoors, however, they may need a structured task on which to focus. Use the following checklist to create the activity that best suits your class. A structured option may involve groups of students, each with a timekeeper and a recorder, exploring for 10 minutes outdoors and then returning to the classroom. A less structured approach may encourage the students to discover on their own and share their discoveries outdoors where the evidence is more readily observable.

- What animals do you think live around your school?
- Find a producer and evidence of a consumer. Where are the decomposers?
- Define the boundaries of the communities.
- How many plants and animals live in each?
- Define the boundaries of one animal's habitat.
- Find evidence that one animal lives in more than one community.
- What indicates change within a community?
- Can a sidewalk crack be a habitat?



Vocabulary

As a result of the pre-trip activities your students should have become familiar with the following words and definitions.

AMPHIBIAN - a vertebrate with soft skin which hatches from a jelly-like egg and spends the first part of its life in the water as a tadpole (e.g., frog, toad, and salamander)

COAL AGE - 70 million years during the Paleozoic Era (the second era) when fossil fuels were formed

COMMUNITY - an area where a set of conditions meets the needs of many animals

CONSUMER - an animal which consumes plants or animals to obtain energy

DECOMPOSER - a living plant or animal which helps to decompose or break down dead plants or animals

ENDANGERED - a species in danger of becoming extinct

ERA - one of four major time periods in earth's history

ERRATIC - a large boulder deposited by a retreating glacier

EVOLUTION - one theory based on the fossil record that explains existing life on earth as a result of changes occurring over long periods of time

EXTINCT - a species that no longer exists

FOSSIL - evidence of prehistoric life

FOSSIL FUELS - non-renewable energy sources such as coal, oil, and natural gas

GLACIER - a huge ice sheet that advanced and retreated across the land

HABITAT - the area where an animal satisfies all of its life needs for survival and reproduction

ICE AGE - the last two million years of the Cenozoic Era (the fourth era) when glaciers covered the northern continents

INVERTEBRATE - an animal without a backbone or internal skeleton

KETTLE HOLE - depression formed from an ice chunk which broke away from the glacier and melted

MAMMAL - a vertebrate which is born alive, has hair, and feeds its young milk

MORAINE - ridges of rock and dirt piled up as a glacier melted

POPULATION - a group of animals or plants of the same kind that live in the same area and interact with each other and the environment

PRODUCER - a green plant that makes food

REPTILE - a vertebrate with dry scaley skin which hatches from a leathery egg (e.g., snake, turtle, lizard)

SUCCESSION - natural orderly change of communities over time

TILL - gravel, sand, and rocks deposited by a retreating glacier

UNICELLULAR - single-celled

VERTREBRATE - an animal with a backbone and internal skeleton

If you'd like to involve your students' parents in "Michigan Natural History" send home a copy of the parent letter included in this packet.

Name _____

Looking Back

Fossils are remains of ancient plants and animals. By studying fossils, scientists have formed different theories about life on earth. Some scientists believe that life began three billion years ago and has been changing ever since. They call this process *evolution.* They have divided the major events of life into four periods called *eras*.

The Precambrian Era or "dawn of life", probably began 4,600,000,000 (between four and five billion) years ago. Sometime during the first era, life is thought to have begun in the sea. *Unicellular* plants and animals were the first organisms to appear on earth.

The Paleozoic Era or "time of ancient life", began about 600,000,000 (six hundred million) years ago. Ocean-dwelling *invertebrates* came into existence. Then fish, the first *vertebrates*, evolved. The later part of this second era is known as the *Coal Age*. During the coal Age huge ferns and trees grew in large swamps. When these plants died and fell into the swamps, they did not completely decompose and instead became coal, oil, and natural gas. These *fossil fuels* supply most of our current energy needs. The fact that oil is being drilled in Michigan today means that the land was once a Coal Age Swamp. What other places in the world also used to be Coal Age Swamps?

The Mesozoic Era or "time of middle life" began 230,000,000 (230 million) years ago. Flowering plants, insects, birds, and a variety of *reptiles* shared the earth. Because of the dinosaurs this third era was nicknamed the *Age of Reptiles*.

Student Handout 1
Michigan Prehistory
Looking Back

The Cenozoic Era or "time of recent life", began around 70,000,000 (70 million) years ago and includes today. Birds and flowering plants increased in number and variety during this fourth era. But vast numbers of *mammals* gave it the name the Age of Mammals. Humans probably first appeared on earth 3,000,000 (three million) years ago. Soon afterwards the *Ice Age* began. At least four different times during the last 2,000,000 (two million) years Michigan was covered by *glaciers*. The last ice sheet melted from Michigan about 10,000 (ten thousand) years ago leaving piles of rocks and holes across the state. Mastodons, mammoths, musk ox, giant beavers, large moose, and early Indians lived in our state then.

modern ↑ ancient

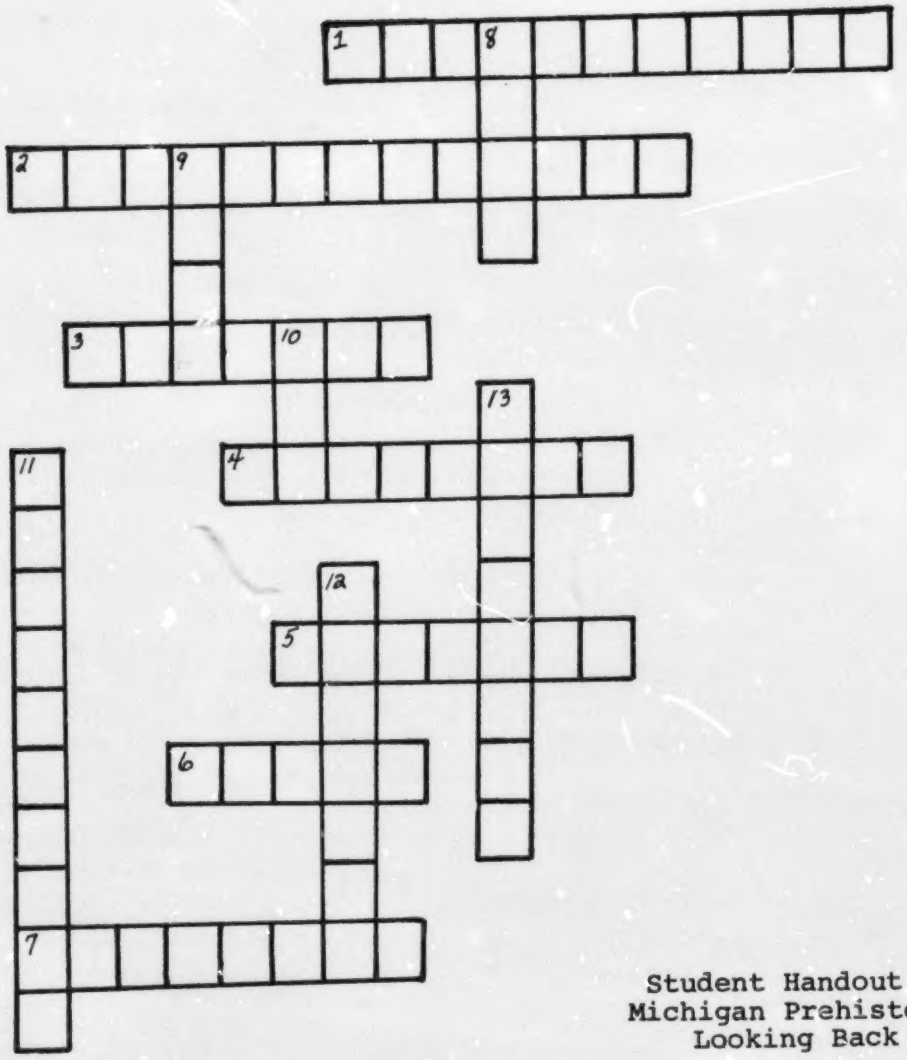
Era	Life in the Sea	Life on Land
4 - Cenozoic		humans
3 - Mesozoic		mammals birds reptiles
2 - Paleozoic	amphibians fish invertebrates	amphibians
1 - Precambrian	unicellular animals	

The First Appearance of Animals

Student Handout 1 continued

A Crossword Puzzle

Name _____



Across

1. The first form of life was _____ or single-celled.
2. animals without backbones
3. remains or traces of ancient plants and animals
4. Dinosaurs were plentiful during the Age of _____.
5. 1,000,000,000 = one _____
6. Coal, oil, and gas are fossil _____.
7. 1,000 = one _____

Down

8. Huge ferns and primitive trees grew in large swamps during the _____ Age.
9. The four major periods of geologic time.
10. Continental glaciers were on earth during the _____ Age.
11. an animal with a backbone
12. 1,000,000 = one _____
13. thick masses of moving ice

Student Handout 2
Michigan Prehistory
Looking Back

Name _____

A Time Line

Time lines are used to record historical events in the order in which they occurred. You can make a time line to record the major events of the past 4.6 billion years!

1. Look at a metric ruler. How long is one meter? a centimeter? a millimeter?

2. Fill in the blanks: 1m = _____cm 1cm = _____mm

3. Figure out the scale below. If 1cm = 10,000,000 (10 million) years, how many years does 1m equal? _____ How many years does 1mm equal? _____ How long will your tape have to be to record 4,600,000,000 (4.6 billion) years? _____

4. Cut your tape. On one end draw a line and label it "now".

5. Using what you know about meters, centimeters, and millimeters, measure off and record the events listed below.

ERA	EVENT	ESTIMATED YEARS AGO	DISTANCE FROM "NOW"
1	1. first marine plant (algae)	3 billion	____ m
	2. first unicellular marine animal	1 billion	1 m
2	3. oldest trilobite	600 million	____ cm
	4. first vertebrate (fish)	500 million	____ m
	5. first land plant	440 million	____ cm
	6. first amphibian	400 million	____ cm
	7. Coal Age began	345 million	____ cm
	8. first reptile	300 million	____ cm
3	9. first dinosaur	225 million	____ cm
	10. first bird	160 million	____ cm
	11. first mammal	160 million	____ cm
	12. dinosaurs become extinct	70 million	____ cm
4	13. first primate	70 million	____ cm
	14. first fossil record of cattle, goats and sheep	10 million	1 cm
	15. first human	3 million	____ mm
	16. Ice Age	1 million	1 mm

Student Handout 3
Michigan Prehistory
A Time Line

Dear Parents,

Our class will be taking a field trip to the Dahlem Environmental Education Center for a program entitled Michigan Natural History. We've been preparing for the trip by studying prehistoric animals and plants and how glaciers shaped our land. At the Center we'll explore the plants and animals of today. When we return to school we'll learn about land use decisions in our community.

This is a good opportunity for you to share with and learn from your fourth grader. S/he may return from our field trip eager to explore your backyard. Why not try one of the following activities?

1. Visit the Prehistoric Life and Michigan Wildlife displays at the Exhibit Museum at the University of Michigan, Ann Arbor. Call 313-764-0478 to find out about week-end hours and visiting fees.

2. Explore your yard, a park, or a vacant lot to discover the different plants and animals that live in each.

3. Talk to different neighbors about why they moved to your community and what they like about living in it.

4. Go to the library and research the history of your community. Can you find books with pictures taken 50 or 100 years ago?

5. Collect newspaper articles about current events affecting your community's development.

Thanks for your support!

Sincerely,

Fourth Grade Teacher

Field Trip

Your adventure at the Dahlem Environmental Education Center will begin with an indoor interpretation of the last three billion years! Your students will appreciate their pre-trip preparation as they skim through time identifying plants and animals that existed during the four major eras. Upon reaching the present, they will prepare to explore the natural communities at the Dahlem Environmental Education Center.

A guide will then lead your group along the Center's trails through the forest, field, marsh, and around a kettle hole pond. Your students will collect information and hypothesize about the history and the future of several additional communities.

After an activity emphasizing the interdependence of all organisms on this planet, your class will be ready for the challenges of the post-trip activities back at school.

Post-Trip Activities

The information and experiences in the pre-trip and field trip portions of "Michigan Natural History" have led your students to a new understanding of our land. The following post-trip activities add a new dimension -- the human component. Each activity is important in helping your students apply field trip concepts to their lives.

1. Looking at Our Values

Not a day goes by that we are not called upon to make decisions. Our decisions vary in difficulty -- some are easy to make; others are not. Some are more important than others. Some affect a few people; others affect many. All of our decisions are made from the basis of our personal values.

As educators, it is important for us to develop students' decision-making skills by providing them with opportunities to examine their values and beliefs. Such activities must be done carefully, however. Every participant needs to be considerate and respectful of others. Everyone has a right to his/her own opinions. All responses are acceptable.

A result of this valuing activity, your students should realize that an issue can have more than two sides and more than one good solution. They may even rethink their own values!

Four Viewpoints

This activity will give your students a chance to consider several environmental issues, communicate their opinions, and listen to different points of view. First, make four signs (STRONGLY AGREE, AGREE, STRONGLY DISAGREE, and DISAGREE) and post each on one of the four walls in your classroom. Then, ask your students to stand in the middle of the room, listen to a statement, and move to the wall that best represents their opinion.

Stress that there are no wrong responses and encourage students not to be afraid to stand alone. Not every student may choose to participate or discuss his/her opinion. Each may exercise the right to "pass". As you read the following

statements choose several which elicit a wide variety of responses. After the students in each group discuss their reasons for making this choice, take time to listen to a summary of each viewpoint.

- Dead trees in the woods should be cut down for firewood.
- People should ride their bikes more and drive their cars less.
- Our community should have more parks.
- People should be willing to pay more for cars that pollute less.
- I wish I had a green concrete yard so I wouldn't have to mow the grass.
- During the winter, people should wear sweaters and turn down the heat.
- Unless they are useful to us, endangered animals should not be protected.
- Land owners should have the right to develop land any way they wish.
- Wildlife habitats should be protected from human destruction.

2. Land Use Decisions

Now that your students have had practice thinking about different issues, forming opinions about them, and listening to other points of view, they're ready to think about land-related problems and explore ways to take action on a local level.

The first three activities in this section will give your students practice in working together to solve land use problems. The culminating activity shows how citizens make community land use decisions. For maximum learning it's recommended that students participate in all four activities in sequence.

If at any point you think that your students would benefit from additional practice working together, try some of the activities in Environmental Education Activities Manual, Green Box, Project Learning Tree, and Values Clarification. (See the reference section at the end of this packet.)

Six Trees

To help your class explore the need for long-term planning read them the following scenario:

> *We have only six fully grown trees on our land. We need firewood and are trying to decide whether to cut all the trees for wood next winter.*

Challenge students to decide what is the best action to take. They may wish to consider:

- shade in the summer
- need for firewood
- animal shelter

When each group has reached a decision, ask one representative to explain its proposal to the class. During the discussion, emphasize the differences between short-term and long-term results of any one action, and the vast array of possible alternatives.*

Summary: Many alternatives must be weighed for good long-term planning.

**Modified from "Long Range-Short Range", Activity 47 of Project Learning Tree (R) Supplementary Activity Guide for Grades K-6 and printed with permission from the American Forest Institute, Inc.*

Land Plan

To investigate the need for cooperative planning, divide your class into groups of six and distribute two 8½" x 11" sheets of unlined paper to each student. Each page represents one acre, about the size of a football field. Ask each group to place their papers on the floor in such a way that each group makes a 3 x 4 acre 'map'.

Each group should work together to draw some basic features on their map -- a lake, road, forest, etc. Next, each person should pick up two adjoining pieces of paper and work individually to develop the pages any way s/he wants. No fair paying attention to a neighbor's work!

When everyone is finished, ask the groups to reassemble their full size maps in the original order. How did they turn out? Could land use patterns be improved if group members worked together to plan? Ask each group to do the activity again, this time cooperating to accommodate as many peoples' original ideas as possible.*

Summary: When people work together, better community planning results.

Modified from "Land Plan", Green Box Curriculum Kit, 1975, and printed with permission from Humboldt County Office of Education, 901 Myrtle Ave., Eureka, California 95501.

Corner Creativity

The best way to teach people how to do something is to let them do it! In this activity, students will make "land use" decisions by redesigning a corner of the classroom. By working together on their "own space", your students will practice the skills land planners use and prepare themselves for wise decision-making in the future.

Choose a corner of the classroom for redevelopment. Before you invite new land use plans, be sure to state the restrictions -- for example, "This reading corner must have 10 chairs in a circle and be conducive to reading."

Then ask groups of students to submit a plan for the "improvement" of the corner. They can rearrange furniture; liven up the place with carpets, posters, pets, and plants; redecorate; or bring in some garage sale specials!

Post the different drawings and designs around the room. After the submitters of each have verbally explained their plans, ask class members to tell why a certain plan pleases them. Over a period of time arrange the corner according to as many of the students' plans as possible.

Summary: Citizens have the power to change their environment for the better.

Going to Council

Now your students are ready to develop and evaluate community land use plans. If there's a piece of vacant property near your school, prepare for this activity by investigating and making a map of it.

If there isn't a readily accessible piece of property, study the map on handout 4. Explain that this land is currently unoccupied and up for sale. Because the land contains several communities similar to the ones your class explored during their field trip, your students are already familiar with some of the plants and animals that live on the site.

Guide your students through the following steps below:

5 min. 'Generate a list of possible uses of the land -- shopping mall, housing development, nature sanctuary, etc.

10 min. 'Consider the short and long-term consequences of each. Then divide students into groups of 4-6 and have each group select one land use to further investigate.

20 min. 'Invite one student from each group to serve on a County Land Use Council. While the groups develop three minute presentations (including visual displays) for presentation to the County Land Use Council, the Land Use Council should get organized. In order to select the best plan, the Council should study handout 5 and draft additional criteria upon which they will make their decision. They may wish to consider cost, environmental effects, jobs created, revenue generated, and organizations opposed to and in favor of the proposed projects.

5 min. 'Allow questions, group discussion, and rebuttal.

5 min. 'After they've had a chance to discuss each proposal, ask the Council to announce their decision to the class!

Next your class of experts can tackle investigating how land use decisions are actually made in your community! Call some real Council members and ask them to speak to your class.

Summary: Community leaders have the responsibility of considering all the plans presented to them and fairly choosing the best. Citizens have the opportunity to make proposals and voice their opinions.

3. Human Ecology

Your students now understand the roles of the producers, consumers, and decomposers in different natural communities. They also know that an animal's habitat is the area in which it meets its needs of life.

We humans also live in places where our needs can be met. Our homes provide warmth and protection. Accessible nearby are stores, gas stations, theatres, and parks.

The parallel between our world and the natural world quickly ends when we look for the producers and the decomposers. The producers we eat are not found in our community -- they grow in the corn fields of Iowa, the banana groves of Costa Rica, and the agricultural valleys of California. Nor are our waste products decomposed in our community or their nutrients recycled. Instead, our garbage is trucked away to landfills where it is buried in clay cells each day.

It is important to think of ourselves as a part of this larger picture and compare our lives to those of wild creatures. After all, we all share the same planet and are governed by the same principles!

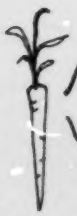
Food Cycles

After a quick review of the concept of producers, consumers, and decomposers, ask your class to name a single producer they consumed recently. Then trace all the steps involved in getting this entrée to your dinner plate. Here's an example with a carrot.

sink – refrigerator – car – store – truck – warehouse – truck – packing plant

planting – plowing – rain & sun – fertilizing – harvest – truck – sorting + cleaning

When you've finally completed the producer's history and have listed all of its requirements of life (sun, air, water, and soil) begin to trace its future! Where will it go after it leaves your plate?



peel – garbage – trash can – garbage truck – landfill – decomposed – nutrients – earth

carrot – mouth – stomach – intestine – anus – toilet – sewage system – wastewater treatment plant

river or cloud – water

landfill or field – nutrients

As they gaze at their completed cycle, ask your students if their community could exist without the rest of the world! We aren't independent at all -- we are very dependent upon a very large area of the earth.

Want to Keep Going?

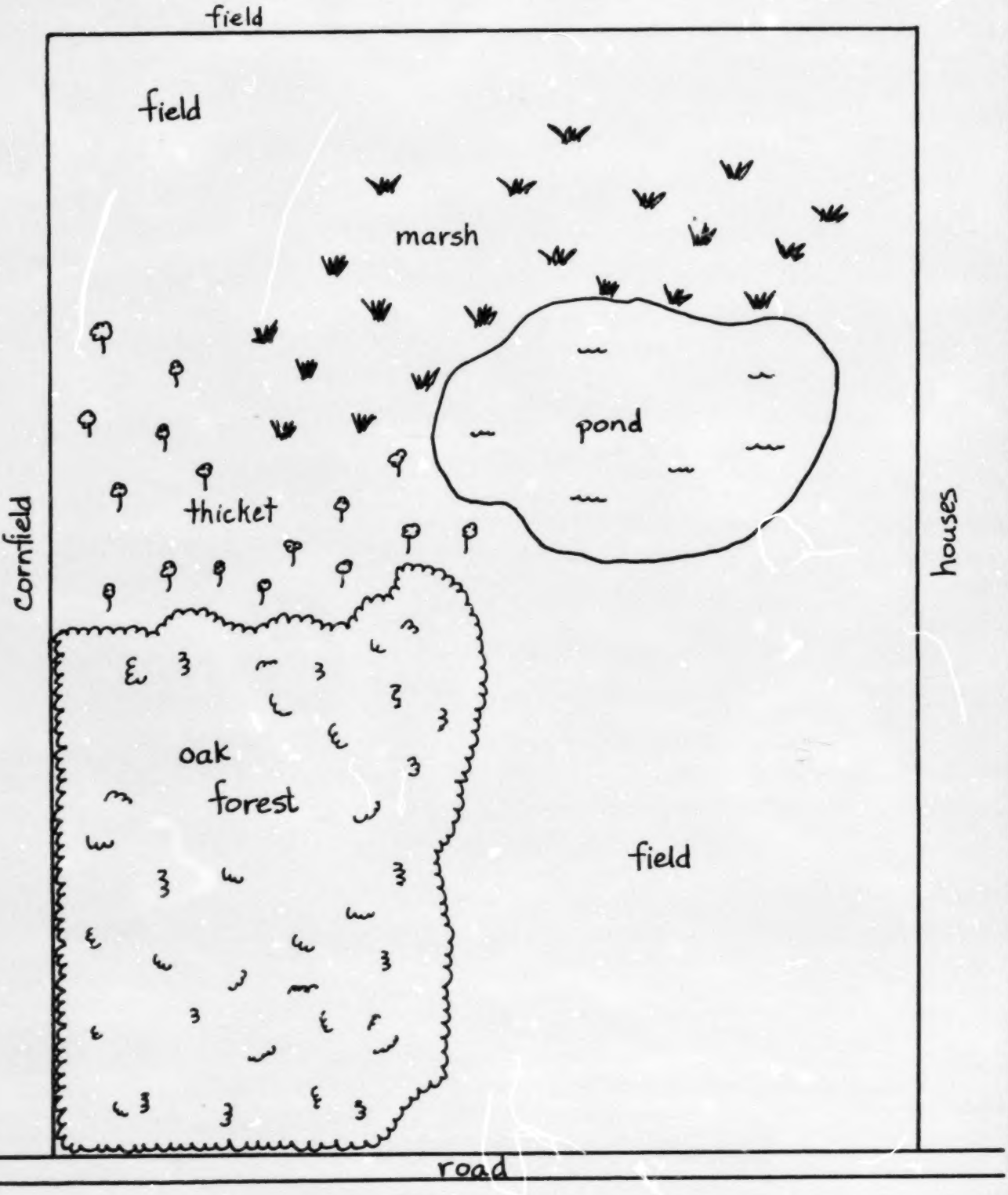
- Highlight every step of the food cycle that took energy. How does a store-bought carrot compare to a home-grown carrot?
- Research a non-food item such as blue jeans or baseball bats to discover its roots and future. Does this have any affect in international politics?
- Find out about products that are produced in your community. Where do they go? Where did the raw materials come from?
- Take one typical school lunch and determine the sources of each ingredient. Where does your food come from?

Phew, you made it! You and your students have completed a study of the past, present, and future of Michigan's land. Your students have built upon a background of prehistory to examine the populations and communities that currently inhabit our land. Then they explored the benefits of land use planning and did some themselves.

You have helped your students gain knowledge and improve their abilities to examine their own values, get along with others, and solve problems. For all of this you and your students deserve a pat on the back. Good job, Teach!

A Map

Name _____


field
field
marsh
pond
thicket
cornfield
houses
oak
forest
field
road

TALLY SHEET

This chart will help you rate the land use proposals. Read this page while your classmates plan their proposals. With the other members of the Council, agree on additional factors to write on the chart. Then write your ideas in the blank spaces.

As you listen to each proposal, rate it according to the factors on the chart. For example, if you think that a proposal would create many jobs, cost a lot, earn a little, create positive environmental effects, and benefit many, you'd write 3,3,1,3,3. (See the example column.) After hearing all of the proposals, total each column. The highest total will suggest which proposal is best. Discuss your results with the entire Council to determine the best one.

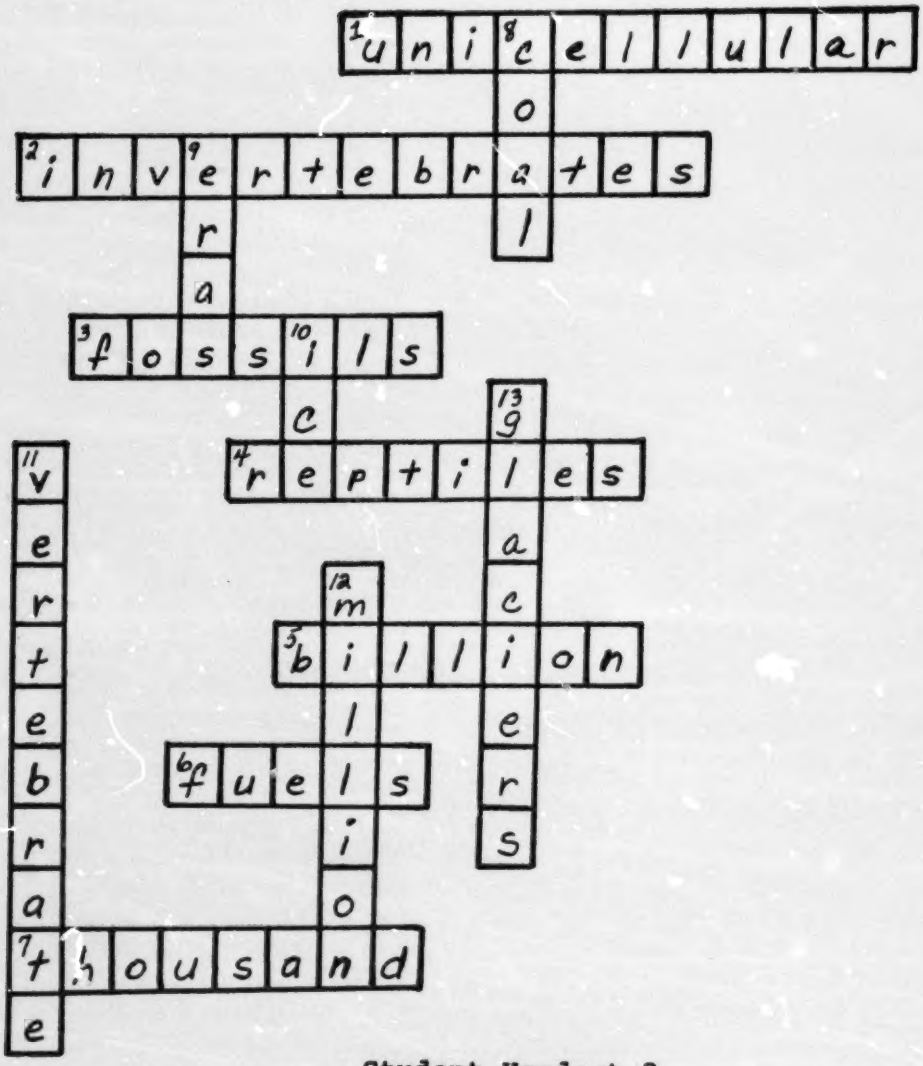
Remember -- as a Council member it is your responsibility to rate each proposal as fairly as possible and to choose the one which will benefit the most people. Good luck!

					Proposals					
					ex.	#1	#2	#3	#4	#5
Factors	A. How many JOBS will be created?	a few 1	some 2	many 3	3					
	B. How much will it COST?	a little 1	medium 2	a lot 3	3					
	C. How much will it EARN?	a little 1	medium 2	a lot 3	1					
	D. What kind of ENVIRONMENTAL EFFECTS will it have?	negative 1	neutral 2	positive 3	3					
	E. How many people will it BENEFIT?	a few 1	some 2	many 3	3					
	F.									
	G.									
	H.									
	TOTALS				13					

Student Handout 5
Land Use Decisions
Going to Council

Answer Key

A Crossword Puzzle


1 u n i 8 c e l l u l a r
o
2 i n v 9 e r t e b r a t e s
r l
a
3 f o s s 10 i l s
c
13 g
4 r e p t i l e s
11 v a
e
r 12 m c
t 5 b i l l i o n
e l e
b 6 f u e l s r
r i s
a o
7 t h o u s a n d
e

Student Handout 2
Michigan Prehistory
Looking Back

A Time Line

Time lines are used to record historical events in the order in which they occurred. You can make a time line to record the major events of the past 4.6 billion years!

1. Look at a metric ruler. How long is one meter? a centimeter? a millimeter?

2. Fill in the blanks: 1m = 100 cm 1cm = 10 mm

3. Figure out the scale below. If 1cm = 10,000,000 (10 million) years, how many years does 1m equal? 1 billion How many years does 1mm equal? 1 million How long will your tape have to be to record 4,600,000,000 (4.6 billion) years? 4.6 m

4. Cut your tape. On one end draw a line and label it "now".

5. Using what you know about meters, centimeters, and millimeters, measure off and record the events listed below.

ERA	EVENT	ESTIMATED YEARS AGO	DISTANCE FROM "NOW"
1	1. first marine plant (algae)	3 billion	3 m
	2. first unicellular marine animal	1 billion	1 m
2	3. oldest trilobite	600 million	60 cm
	4. first vertebrate (fish)	500 million	50 cm
	5. first land plant	440 million	44 cm
	6. first amphibian	400 million	40 cm
	7. Coal Age began	345 million	34.5 cm
	8. first reptile	300 million	30 cm
3	9. first dinosaur	225 million	22.5 cm
	10. first bird	160 million	16 cm
	11. first mammal	160 million	16 cm
	12. dinosaurs become extinct	70 million	7 cm
4	13. first primate	70 million	7 cm
	14. first fossil record of cattle, goats and sheep	10 million	1 cm
	15. first human	3 million	3 mm
	16. Ice Age	1 million	1 mm

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* These books are available at the Jackson Ditrict Library. Similar titles may be found at the Library's 16 branches under the same Dewey Decimal numbers.

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At RFMC...

The Jackson County Intermediate School District's Regional Educational Media Center has the following:

Books:

•Dinosaurs and Other First Animals
SE 3019, science shelf 2
8 readers, 1 cassette, 1 program guide, and 2 worksheet masters

•My Visit to the Dinosaurs, Aliki. New York: Thomas Y. Crowell, 1969.
SE 3622, science shelf 22

Filmstrips:

•"Glaciers and the Ice Age"
KT 0494, science shelf 6
4 filmstrips and 4 cassettes: "Investigating a Glacier," "Reconstructing the Ice Age," "How a Glacier Shapes its Valley," and "Some Side Effects of the Ice Age."

Models:

•Earth History
SE 451.1, science shelf 19
4 cassettes, 1 teacher's guide, a plastic chart of the eras, and some fossil replicas.

Motion Pictures:

"The Beginning and Development of Life"	MP 99
"Coal - The Rock That Burns"	MP 2378
"Digging Up the Past"	MP 303
"Dinosaurs - The Age of the Terrible Lizard"	MP 304
"Dinosaurs: The Terrible Lizards"	MP 2613
"Ecology of a Forest"	MP 344
"Ecosystems - Inter-relationships"	MP 811
"Extinction - A Lesson from the Past"	MP 394
"The Great Lakes - How They Were Formed"	MP 532
"Hot-Blooded Dinosaurs"	MP 2525
"How We Know About the Ice Age"	MP 753
"A Million Years of Man"	MP 1082
"Our Changing Earth"	MP 2460
"Rocks that Reveal the Past"	MP 1976
"Secrets of the Ice - Glaciology"	MP 1990
"Succession - From Sand Dune to Forest"	MP 472
"Time, Lines and Events"	MP 1564

Pictures:

"Learning About Dinosaurs"
SP24.1, science shelf 27

AND ELSEWHERE...

The Exhibit Museum at The University of Michigan displays extensive collections of pre-historic and modern life. Many dinosaur-related educational materials are available at the museum's gift shop. The museum's phone number is (313) 764-0478.

MICHIGAN NATURAL HISTORY

Fourth Grade Spring Trip

Formal Objectives

Collect, organize, and analyze information about several natural communities.

Correctly sequence successive natural communities.

Identify land formations caused by natural geologic change.

Identify the producers, consumers, and decomposers in human and natural environments.

Informal Objectives

Understand the history of the land.

Understand how the natural world works.

Compare major communities at the Center.

Appreciate their world a little more.

Indoor Portion

Welcome the group. Introduce yourself, the other guides, and the Dahlem Center.

"Today we are going to look at the plants and animals that live in southern Michigan today, and the types of critters that have lived here in the past. Michigan has changed through the ages, and we still don't know everything about our history. In fact, since no one was here to watch those changes, all of these ideas are theories--best guesses--about what happened. There are a variety of theories, some very different from the ideas we will talk about today."

Explain that we think the world is 4-5 billion years old. Life probably started in the ocean as single-celled plants, and later animals, but since these creatures left no fossils, we don't really know. A fossil is evidence of prehistoric life: bones, tracks, leaves, teeth, molds, casts, etc.

The earliest known fossils show blue-green algae about 2.5 billion years ago. (Point to the blue side of the first board and indicate that Michigan was a warm salty ocean for most of the time).

SE045125

Abundant fossils are found, beginning 600 million years ago. (Explain some of the organisms, and put up the aquatic invertebrate sheet):

trilobites -- hard-shelled, joint-legged ancient relatives of the lobster, 3 body parts (tri-)

cephalopods -- ancient relative of the octopus and squid with a long, shelled tail and grasping tenacles

corals and sponges -- some similar to today's variety; our Petoskey stone is a coral named Hexagonaria

sea lilies -- feathery animals on long stalks related to the sea anemone and starfish

Skipping up to 300 million, (and adding the next picture to the board), we've entered the Coal Age. The climate was hot, muggy, and damp. Many of the plants and animals never completed decomposed, and after they died, were buried in mud and squeezed together, forming coal, oil, and natural gas -- fossil fuels. So the gasoline that got them here might have been:

Giant Horsetails -- a 50' relative of our 1-2' horsetail, scouring rush, or snakegrass

Huge ferns and mosses

Cockroaches as big as your hand

Dragonflies with an 18" wingspan

Amphibians -- the first vertebrate to leave the water, and the beginning of land inhabitants.

200 million - 70 million was the Age of the Reptiles, which the group will know as the Dinosaurs Era. There is no evidence of dinosaurs in Michigan because the glaciers scraped that layer of rock away. It is not known if dinosaurs were even here. Consequently, our boards do not illustrate this period of time.

The climate became considerably cooler about 1 million years ago as the Ice Age came. The weight of continuous snow in northern Canada piling up turned some of the snow to ice, and eventually formed the continental glacier. Ice up to one mile thick covered Michigan four different times. (Bring the large styrafoam ice sheet over the left side of the board.) The glacier scraped off the existing soil, leaving it in piles in Ohio and elsewhere, and left boulders, sand, and gravel in particular places across Michigan. Around the Dahlem Center (pick up the screen covering the retreating glacier), our hills are piles of glacial till (unsorted sand and gravel), and the

low spots from ice blocks and melting water. Our pond was formed when water carried till around an ice block, and depositing it in a ring around the block. When the ice melted the remaining depression was later filled with water, creating a pond.

Even the Great Lakes reached their present capacity as a result of the glaciers. The ice sheets moved down pre-existing river valleys (the path of least resistance), opening large basins that eventually filled in with water.

A few animals followed the retreating glacier and moved back into Michigan. These animals were adapted to cold climates and ate the sparse vegetation (fir and spruce trees, etc.):

Scott's moose

Mammoth

Mastedon (smaller than Wooly mammoth)

Musk Ox

Giant Beaver (stood 5 feet tall and ate aquatic plants)

Paleo Indians (humans ate large game, hunted with spears)

(Take down this board, leaving the modern Dahlem Scene visible.) Hand out several native animals and ask the kids to place them in their appropriate homes on the board.

Point out that each animal lives in a different "habitat" (as seen by their choice of homes). Each habitat contains all the water, food, shelter, air, and space that an animal needs to live. When aminals meet these needs in the same area with a grouping of plants, a "community" can be defined. This board shows the forest, the pond, and the field communities. Some habitats are within a community (squirrel), and some extend over several (fox).

Communities age and change over time. Remember the glaciers? Many plants have grown and died over 10,000 years to give us what we know now. SUCCESSION is the pattern of community change. What is the human habitat? Is it changing over the years? What will it be like in 200 years?

Suggested Trail

Through Arboretum and into oak woods to the left, across boardwalk and over to the old pond. Return to the entrance of the boardwalk and then continue on the other half of the loop around the woods.

Activities

The main objective is to have the kids explore several communities and make their own assumptions and comparisons by the end of the program. With that in mind, the first section of the walk should open up their eyes to each community, and to understanding how it all fits together.

In the Oak Woods -- Discuss producers and consumers, explaining energy and nutrient flow. Then what? Point out decomposers and their critical role in a community. It's good to compare a very rotten log with the recently toppled oak tree on the path (July 1980 storm).

In the Marsh -- More producers, consumers and decomposers. Some are repeated from the forest (raccoon, deer) and some are very different (redwing blackbird, cattail, oak tree, squirrel). That's because an animals habitat may be large enough to include several communities, or it may be confined to one community.

On the Hill -- Briefly list producers, consumers, and decomposers for the field, and remember the glaciers as you gaze across the fields. As they melted back, the glaciers left immense piles of rock and dirt, as well as ice blocks (our pond). Tell your group they can now see most of the Dahlem Center, and are already acquainted with much of the property. Point out the boundaries of the property and hint that they will have an activity at school involving land use decisions.

At the Pond -- From the Observation Deck, overlook the pond and ask the group it if's getting bigger or smaller over time. Point to the original size and explain the succession of small, land-locked ponds.

Comparing Communities -- Climb back up the hill, and toward the boardwalk telling the students they are going to be analyzing three communities, similar to ones they've already seen. Divide the group in thirds, and distribute to each a thermometer, clipboard, pencil, and data sheet. Leave one group in the field, one in the "thicket" and hike one into the "forest". Give them about 5 minutes to collect the data and make observations, then regroup the class at the first site, asking the field people to give the rest of the class a tour. Accept their boundary, but when the thicket people describe their boundary, challenge it. We can't have some land in two communities, or space that is in neither. Leave it as a question until the forest people are done. Use their observations and boundaries to clinch the concept of succession. Continuous change makes for fluctuating boundaries.

King Snoid -- On the return trip, stumble across King Snoid's declaration and ask the group what they think about it. Encourage them to take two minutes to find an example of interdependence. See Sunship Earth, pp. 105-108.

On the Bridge -- Take a few minutes to rest and listen to the sounds in the woods. Ask your group, "Of all the animals that live here, which would you most like to turn into?" See "Aliases" and "Whispers" in Acclimitizing.

In the Arboretum-- Congratulations! Your group now has a quick but complete understanding of communities on the natural world. Tell them that back at school they'll investigate the community they live in.

Ask them to pretend that the city has a peice of property with the same communities (pond, marsh, field, thicket, forest, etc.) as the Dahlem Center. And, because of their expertise on communities and land use, the city council wants them to decide on the best use of that parcel of land. Explain that after their return to school, they'll be given a map and will work in small groups to make their recommendations. Encourage students to take one last look at the Dahlem Center on their return to the parking lot!

Comparing Communities

A COMMUNITY is a group of plants and animals that live together in an area where their needs of life are best met.

1. This community is called a _____

2. Name three producers that you see growing.

_____

3. Find evidence of three consumers that live here or may use this area. Who are they?

_____

4. Are there any decomposers in this community? What role do you think they serve?

_____

_____

5. Physical Features:

What is the air temperature?_____

How light is it? (circle one)

Very Dark	Dark	Medium	Bright	Very Bright

How wet it it? (circle one)

Very Wet	Wet	Medium	Dry	Very Dry

6. What evidence of change do you observe?

_____

7. What are the boundaries of your community?

_____

_____

Get ready to give your classmates a tour of your community and to take a tour of theirs!

DAHLEM ENVIRONMENTAL
EDUCATION CENTER
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Jackson, Michigan 49201
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